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Dated 14 December 2004

Patents Form 1/77

Patents Act 1977
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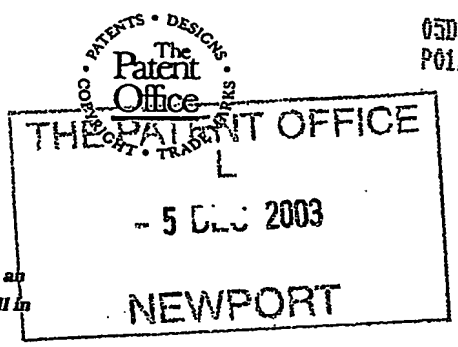

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P01/7700 0.00-0328239.9

1/77

Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

The Patent Office

Cardiff Road
Newport
South Wales
NP10 8QQ

1. Your reference

613GB

2. Patent application number
(The Patent Office will fill in this part)

0328239.9

05 DEC 2003

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

Renishaw plc
New Mills
Wotton-under-Edge
Gloucestershire, GL12 8JR

Patents ADP number *(if you know it)*

2691002

If the applicant is a corporate body, give the country/state of its incorporation

United Kingdom

4. Title of the invention

Manufacture Of Dental Prostheses

5. Name of your agent *(if you have one)*

M J Fowler et al

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

Renishaw plc
Patent Department
New Mills
Wotton-under-Edge
Gloucestershire
GL12 8JR

Patents ADP number *(if you know it)* 2691003

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*
–	–	–

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing *(day / month / year)*
–	–

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:*

a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
c) any named applicant is a corporate body.
See note (d))

Yes

9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form	0
Description	5
Claim(s)	0 DK
Abstract	0
Drawing(s)	2 ~~1~~ 2

10. If you are also filing any of the following, state how many against each item.

Priority documents	0
Translations of priority documents	0
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	0
Request for preliminary examination and search *(Patents Form 9/77)*	0
Request for substantive examination *(Patents Form 10/77)*	0
Any other documents *(please specify)*	0

11. I/We request the grant of a patent on the basis of this application.

Signature [signature] Date 04.12.2003

AGENT FOR THE APPLICANT

12. Name and daytime telephone number of person to contact in the United Kingdom: A Iles 01453 524524

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d) *If you have answered 'Yes' Patents Form 7/77 will need to be filed.*

e) *Once you have filled in the form you must remember to sign and date it.*

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MANUFACTURE OF DENTAL PROSTHESES

This invention relates to a method of determining the shape of a dental prosthesis and in particular dental bridges.

Conventionally in the manufacture of bridges a preparation is provided. This preparation is often a positive plaster impression of the section of the mouth which requires the bridge work. It comprises at least two anchors which are located either side of the missing tooth. The preparation is scanned in order to provide the internal dimensions of the bridge. Next, wax is built up in layers over the anchors and at the location of the missing tooth forming a pontic or replacement tooth thus producing a desired external shape for the bridge. The anchors require only a thin layer of wax which represents the thickness of a coping which rests over the anchor surface supporting the bridge. Once the wax-up is complete the anchors and replacement wax tooth are scanned to produce the external surface dimensions of the bridge. The wax-up stage of the procedure is both time consuming and requires skilled labour.

The invention provides a method of determining the shape of a dental prosthesis comprising the steps of:

a) scanning at least a connecting portion of a preparation, wherein the preparation comprises first and second anchors and a connecting portion therebetween;

b) building a wax model on the connecting portion to produce a pontic; and

c) scanning at least the pontic whereby the

surfaces of the first and second bridge anchors are also scanned during step a or step c.

In order to produce the copings which will fit onto the first and second bridge anchors and support the bridge, an offset is added to the data produced when the first and second bridge anchors are scanned. The use of such an offset therefore negates the necessity of waxing-up the first and second bridge anchors and thus makes the whole process less time consuming.

To ensure that the bridge is comfortable for the wearer, the gum-side surface of the pontic is offset from the gum line by for example 100 microns.

The invention will now be described by way of example and with reference to the accompanying drawing, of which:

Figs 1a-1d show different stages used to determine the shape of a dental prosthesis.

Fig 1a shows a tooth preparation 10 which in this case comprises a first anchor 12, a connecting portion 14 and a second anchor 16. The first and second anchors are located on opposite sides of the connection portion 14. The connecting portion 14 is the location of a missing tooth which will be replaced with an artificial tooth or pontic by the bridge.

The surface of the first and second anchor 12,16 and the connection portion 14 are scanned using a probe 18 having a scanning tip 20. This may be done as a single block for example by CT or MRI scan of using a non-

contact scanning device as described in US Patent No. 6,217,334. The resultant data from the scan is indicative of the interior surface of the copings which will be produced to cover the first and second anchors.

Alternatively, the model is initially scanned to establish the relative locations of the different parts of the bridge then, each tooth part is scanned separately, to enable complete scanning of each and, the bridge configuration is determined by combining the data from the individual scans using the data regarding the relative locations of the different parts obtained in the initial scan. A number of impressions may be used in this embodiment enabling the models used in each step of the process to be retained in case difficulty arises in, for example, combining the data so, the relative locations of the bridge parts requires confirmation. Or, the three portions of the bridge may each be scanned individually as is described in our co-pending UK Patent Application Number GB0327698.7.

Referring now to Fig 1b a wax model of a replacement tooth or pontic 22 is created on the connecting portion 14. This wax-up model is also scanned.

The wax model of the replacement tooth preferably incorporates connectors which span the gap between the replacement tooth and the first and second anchors. The connectors join the different parts of the bridge together. Alternatively, the wax-up of the replacement tooth comprises merely the tooth part and the connectors are added during a different process, such as a data manipulation step by a mathematical technique or visually altering the data, for example.

In order that the bridge is only supported by the two bridge anchors 12,16 an offset 24 (Fig 1c) is produced between the connecting portion 14 which represents the gum of the patient and the gum-side surface of the wax-up 22 which represents the replacement tooth. This prevents any damage to the gum from the bridge.

The offset 24 between the connecting portion 14 and the wax-up 22 is produced by manipulation of the data obtained from the two scans that have been conducted. One way of achieving this is to take the data which represents the surface of the connecting portion 14 and add an offset of for example 100 microns to this data to produce a mathematically determined end to the pontic. Alternatively, if the data is represented visually, on a computer monitor for example, then an operator can decide where to locate the end of a pontic by marking a line on the screen.

Referring now to Fig 1d, in order to support the pontic a shell of material is placed over each anchor 12,16. These shells are known as copings 112 and 116 respectively. The copings 112,116 are not produced by applying a layer of wax to the first and second anchors 12,16. Data from the scan of the first and second bridge anchors is manipulated in order to produce an offset, the amount of the offset indicating the thickness of the coping.

Thus the scanned data of the first and second anchors 12,16 along with the determined end of pontic comprises the inner and under surface of the bridge. The offset data from the scan of the first and second anchors along with the scan of the wax-up 22 produces the

exterior surface of the bridge.

The manipulated data is subsequently used in the manufacture of the custom made prosthesis.

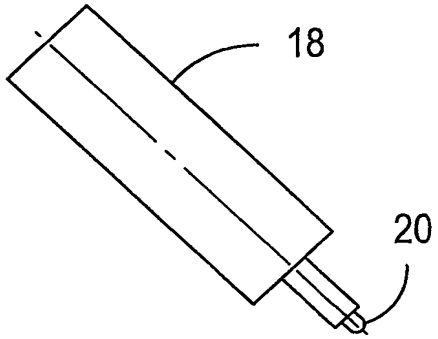


Fig. 1a

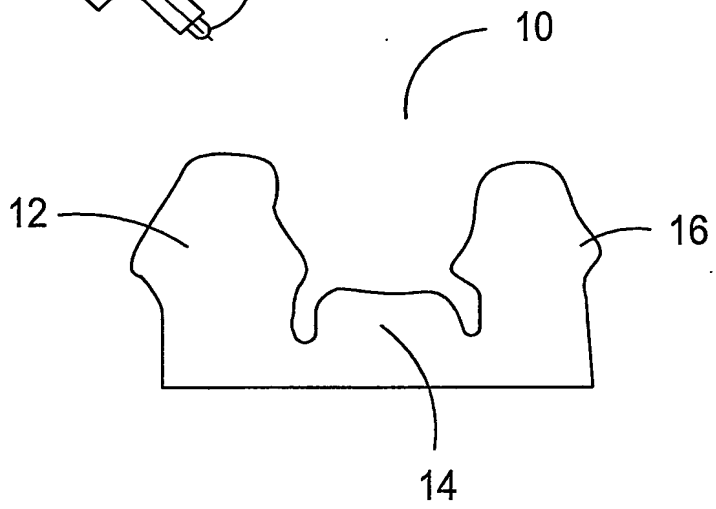


Fig. 1b

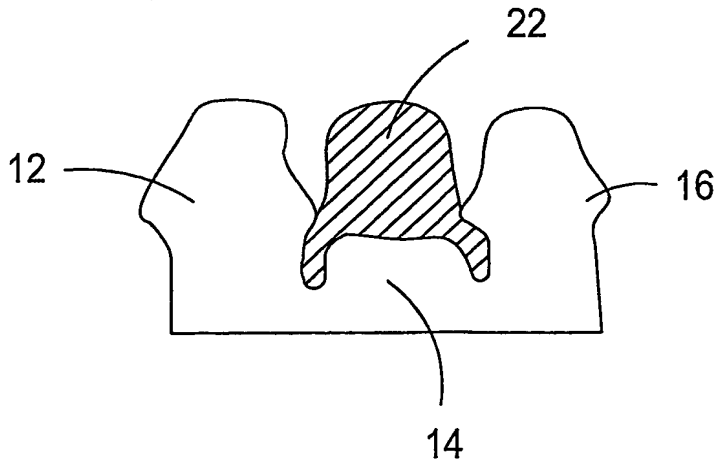


Fig. 1c

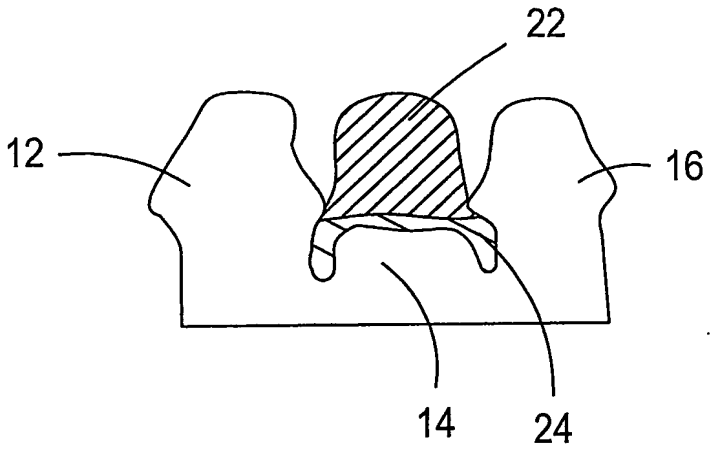
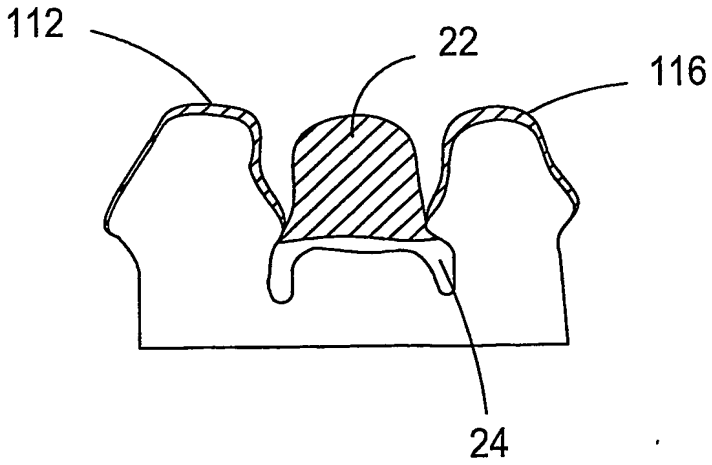


Fig. 1d



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